

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

TARDIGRADA FROM THE BARRANCA DEL COBRE,
SINALOA AND CHIHUAHUA, MEXICO

BY ROBERT O. SCHUSTER
Department of Entomology,
University of California, Davis, 95616

Tardigrades from four localities along the Barranca del Cobre were collected by T. A. Sears, R. C. Gardner, and C. S. Glaser in July, August, and September of 1969¹. The four towns around which the collections were made are: Choix, Sinaloa, 275 m elevation; Temoris, Chihuahua, 1,370 m; Cuicateco, Chihuahua, 1,710 m; and Creel, Chihuahua, 2,195 m. No climatological records are available for these localities, but local habitat information is summarized in the discussions for each tardigrade species.

Over 150 samples consisting mainly of lower plants were processed. These samples were washed in the field; the specimens were fixed in boiling water and preserved with formalin. The tardigrades subsequently were mounted on slides in an iodine-Hoyer's medium. All descriptions, measurements, and illustrations are from these slide-mounted specimens.

The important characteristics of each species are briefly discussed or illustrated. The Tardigrada of Mexico are essentially unknown, and compilation of this information for the fauna of one area may both stimulate and facilitate further inquiry.

Echiniscus Schultz, 1840

Echiniscus viridis Murray, 1910

Figures 1, 2

This species is distinguished by a dark green color, by a polygonal cuticular pattern (Fig. 2), and by the short (30 μ -40 μ) lateral spine A (Fig. 1,a).

¹T. A. Sears and R. C. Gardner were in Mexico with support from an American Philosophical Society Grant, 5192 Penrose Fund.

Five specimens with lengths between 175 μ and 300 μ were recovered from a lichen and a small bromeliad, *Tillandsia recurvata* (L.) L., growing on the face of a cliff at Cuiteco, 14 September 1969. A single specimen was taken from lichen on a tree in Creel, 8 September 1969.

Echiniscus tamus Mehlen, 1969

Figures 3–6

Emended description. Length to 235 μ exclusive of legs IV. Eyes absent. Cuticle of anterior half of plate pairs I and II, anterior margin of median plate II, and median plate III of separate, raised polygons (Fig. 3); remaining plates with pores of about 1 μ diameter, cuticle between pores consisting of minute rounded tubercles, appearing as uniformly neutral background with irregular dark spots at high magnification (Fig. 4), neutral with fine dark stipple and irregular pores at low magnification (Fig. 5); ventral surface smooth. Head plate divided into small anterior and large transverse posterior pieces; scapular plate incised posterior to spine A; end plate incised, not faceted. Internal buccal cirrus (Fig. 3, i) basally enlarged, about 14 μ long; papilla about 8 μ (Fig. 3, p); external cirrus (Fig. 3, e) basally enlarged, about 22 μ long. Leg I with small spine, II and III with minute papilla, IV with basal papilla, faintly sculptured, with dentate collar of about 8 teeth; internal claws of legs I–IV with weak basal spur, external claws simple (all claws of holotype simple).

The only previous record of the species is the type locality in College Station, Texas. The type was collected from lichen on *Quercus stellata* Wangenh. and is deposited as number 38917 in the Division of Worms, National Museum of Natural History. Nineteen examples were collected at Cuiteco, Chihuahua, Mexico on 14 September 1969, from bromeliads, *Tillandsia recurvata* (L.) L., on the face of a rock cliff. Four additional specimens were taken at the same locality from a lichen, *Usnea hirta* (L.) Wigg. These specimens vary in length from 180 μ to 235 μ .

This species is unique within the *E. arctomys* group because of the structure and distribution of the two types of cuticular patterns. It is

→

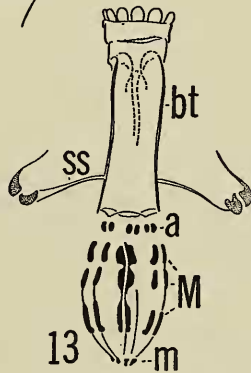
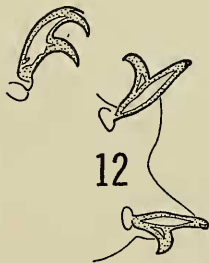
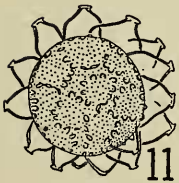
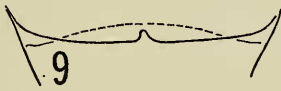
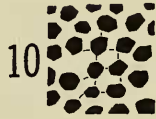
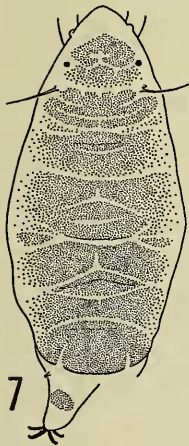
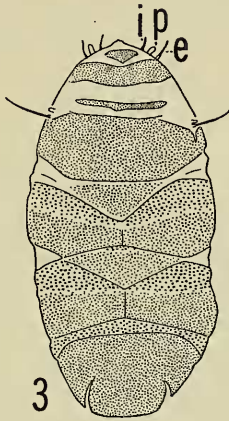
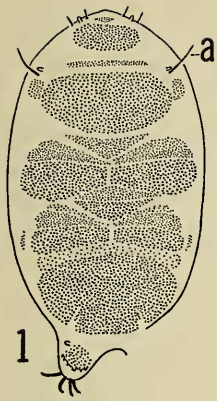
FIGS. 1, 2. *Echiniscus viridis*. 1. Dorsal view. 2. Detail of cuticular pattern.

FIGS. 3–6. *Echiniscus tamus*. 3. Dorsal view. 4 and 5. Cuticular pattern (fine stipple on Fig. 3). 4. High magnification. 5. Low magnification. 6. Cuticular pattern (coarse stipple on Fig. 3).

FIGS. 7–9. *Pseudechiniscus* sp. 7. Dorsal view. 8. Cuticular pattern (area is 0.085 μ sq.). 9. Bilobed pseudosegmental plate.

FIG. 10. *Pseudechiniscus suillus facettalis*. Cuticular pattern.

FIGS. 11–13. *Macrobiotus richtersi*. 11. Egg. 12. Claws of leg IV, unpaired claw is lateral view. 13. Buccal tube and placoids.



somewhat similar to *E. rufoviridis*, which I have not seen but that species is described as having a partially green cuticle as well as claws without basal spurs.

Pseudechiniscus Thulin, 1911

Two species of this genus were collected at Cuiteco. Both belong to the *P. suillus* group which is characterized by the absence of lateral spines except in position A. The species from Cuiteco have similar dorsal facies (Fig. 7).

The *P. suillus* group needs revision, and I am unable to identify one of the two species present in the Cuiteco collections.

Pseudechiniscus species

Figures 7-9

This species is recognized by the following characters: granulation of cuticle (Fig. 8) uniform, circular, 0.85μ or less in diameter; posterior margin of pseudosegmental plate weakly bilobed (Fig. 9); buccal papillae very short.

Of the two described species in which the pseudosegmental plate is bilobed, *P. ramazzottii* Maucci has coarse cuticular granulation and globose buccal papillae, and *P. scorteccii* Franceschi has two conical processes on the terminal plate. This species keys to *P. ramazzottii* in Ramazzotti's monograph (1965), but is incompatible with the description of that species.

Thirteen specimens are from Cuiteco, 11 September 1969, and were collected in lichens on northerly exposed rocks near a stream. The shortest is 135μ long and the longest is 200μ .

Pseudechiniscus suillus facettalis Peterson, 1951

Figure 10

This species is easily distinguished from the previous by the granulation of the cuticle which is polygonal, the granules often in excess of 1.0μ in diameter, and at times faintly interconnected (Fig. 10). The cephalic and terminal plates are sharply deflexed laterally, giving these plates a faceted appearance.

Specimens identified by previous workers have not been seen, and the determination is based on literature. The species has been reported from Greenland, Italy, and Tierra del Fuego. Thirty specimens ranging in lengths from 135μ to 205μ were recovered at Cuiteco, 11 September 1969, from lichens on a bank of rocks with a north exposure. Although the collections were from the same site at which the preceding species was found, the two species were mutually exclusive in seven out of eight samples.

Macrobiotus Schultze, 1834

The genus *Macrobiotus* is distinguished by the buccal tube (Fig. 13, bt) having a ventral support (Fig. 19, vs), and the two double claws of

each leg being of similar size and shape. The closely related genus *Hypsibius* has dissimilar claws and the buccal tube usually lacks the ventral support. The one exception considered here is *Hypsibius evalinae* Marcus, a species with a well-developed buccal tube support. The species of *Macrobiotus* from the Barranca del Cobre are quite distinctive and can be recognized by the proportions of length to width of the buccal tube and by the number and shape of the placoids (Fig. 13, M = macroplacoid, m = microplacoid).

Macrobiotus richtersi Murray, 1911

Figures 11-13

Macrobiotus richtersi is recognized by a wide buccal tube with the stylet supports (Fig. 13, ss) attached basally. The pharynx contains the apophyses (Fig. 13, a), three macroplacoids, and microplacoids. Eye spots are absent. The egg (Fig. 11) is of value in the identification of this species.

M. richtersi is represented by 26 specimens, and is apparently restricted to moist habitats. Nine samples from four areas contained this species. These were: Temoris, 4.8 km SSW, 28 August 1969, lichen on oak log in wet, shady forest; Cuiteco, 6 September 1969, mixed lichen and moss on rock in seepage from a spring; Cuiteco, 10 September 1969, club moss in crevices in wet bank; Cuiteco, lichen on rocks near stream.

Macrobiotus areolatus Murray, 1907

Figure 14

The buccal tube and macroplacoids are similar to those of *M. richtersi*, but the stylet supports are attached more anteriorly, and microplacoids are absent. Eye spots are present.

One-hundred fourteen specimens were collected at 1.6 km NE, 3.2 km N, 4.8 km SE, and 4.8 km SSW Temoris, at Cuiteco, and at Creel. Eighteen samples in which this species was found were of lichens, mosses, mushrooms, and bromeliads, and were from both wet and dry situations. Body length ranged between 200 μ and 800 μ .

Macrobiotus harmsworthi coronatus Barros, 1942

Figures 15, 16

The stylet supports of this species are attached at a distance from the base of the buccal tube of at least one diameter of the tube. The pharynx contains small apophyses, three macroplacoids of which the third is slightly longer, and elongate microplacoids. Eye spots are absent. The egg is about 100 μ in diameter and has processes as illustrated in figure 15.

This animal is the same as that reported from the Galàpagos by Schuster and Grigarick (1966), and from Santa Cruz Island, California,

(Schuster and Grigarick, 1970). It differs from the nominate subspecies mainly by the absence of eyes, and by the processes of the egg which are more elongate and sometimes distally bifurcate.

The variation of characters attributed to this species, especially characters of the eggs, is greater than should be expected. When specimens become available from more localities, *M. harmsworthi* might well be re-evaluated.

Sixty-eight specimens were found in one sample from Temoris and 17 samples from Cuiteco. The Cuiteco samples were all from moist or shaded habitats, specifically: moss and *Selaginella* on wet banks, mosses and lichens on rocks near a stream, and lichen on a boulder in a deep canyon.

Macrobiotus hufelandii Schultze, 1833

Figures 17, 18

The pharynx of *M. hufelandii* contains the apophyses, two macroplacoids with the first incised near middle, and microplacoids. Eye spots are present. Sixty-one specimens ranged in length from 260 μ to 470 μ . The buccal tubes are between 38 μ and 50 μ in length and 4 μ to 7 μ in width. Increased length and width measurements of the buccal tube are fairly well correlated to the overall length of the specimen. Eggs of this species were not found.

These specimens were from one sample at Temoris and 17 samples at Cuiteco. The species was found in the same habitats as *M. harmsworthi* and, with few exceptions, in the same samples.

Macrobiotus intermedius Plate, 1888

Figures 19, 20

This species is recognized by a thin (2.5 μ diameter for a tube length of 30 μ) buccal tube that is deflexed anteriorly, and the stylet supports which are attached near the middle. The round pharynx contains apo-

→

FIG. 14. *Macrobiotus areolatus*. Buccal tube, placoids, eye spots.

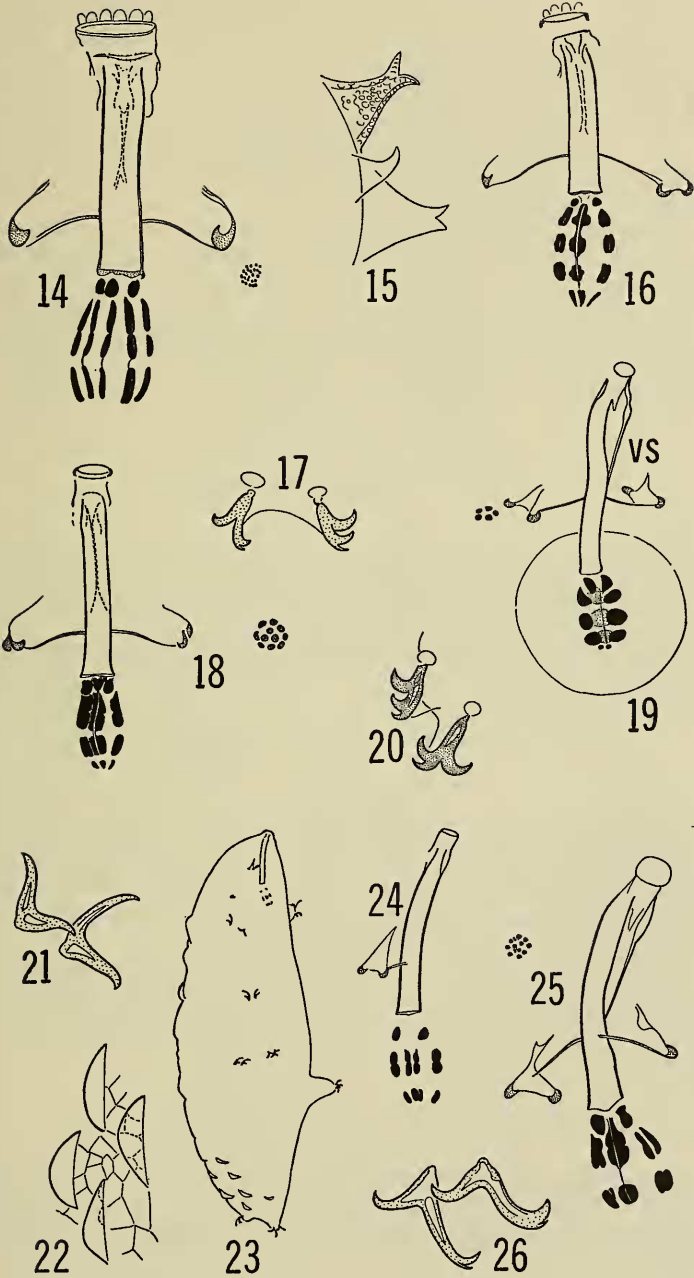
FIGS. 15, 16. *Macrobiotus harmsworthi coronatus*. 15. Processes of egg. 16. Buccal tube and placoids.

FIGS. 17, 18. *Macrobiotus hufelandii*. 17. Claws of leg IV. 18. Buccal tube, placoids, and eye spots.

FIGS. 19, 20. *Macrobiotus intermedius*. 19. Buccal tube, placoids, and eye spots. 20. Claws of leg IV.

FIGS. 21-24. *Hypsibius* sp. 21. Claws of leg IV. 22. Detail of gibbosities. 23. Dorsolateral view. 24. Buccal tube and placoids.

FIGS. 25, 26. *Hypsibius evalinae*. 25. Buccal tube and placoids. 26. Claws of leg IV.



physes of a size subequal to the first macroplacoids, two macroplacoids, and microplacoids. Eye spots are present but small. The range for body length was between 150 μ and 310 μ .

The distinction between three species, *M. ascensionis*, *M. intermedius*, and *M. subintermedius* is based on the morphology of the egg. Unfortunately the egg stage was not recovered. I have tentatively determined these specimens as *M. intermedius*, a common North American species as discussed by Riggin (1962).

Although *M. intermedius* was found in 18 samples, it was not abundant and only 72 specimens were recovered. One collection was from 3.2 km N of Temoris, 19 July 1969, one was from 6 km SW of Temoris, 2 September 1969, and 16 were from Cuiteco, on various dates from 30 August to 21 September 1969. Specimens were recovered from both dry and wet situations, and plant associations include lichens, mosses, *Selaginella*, and bromeliads.

Hypsibius Ehrenberg, 1848

Hypsibius (? *Isohypsibius*) species

Figures 21–24

A considerable number of *Hypsibius* species have been based on the number, size, and location of dorsal gibbosities in various ranks and files. A single specimen in our material is a poor preparation and the number and placement of the gibbosities cannot be determined. The specimen, 170 μ long, was collected at Cuiteco, 6 September 1969, from *Selaginella* in a rocky, spring fed seep.

Hypsibius (*H.*) *evalinae* Marcus, 1928

Figures 25, 26

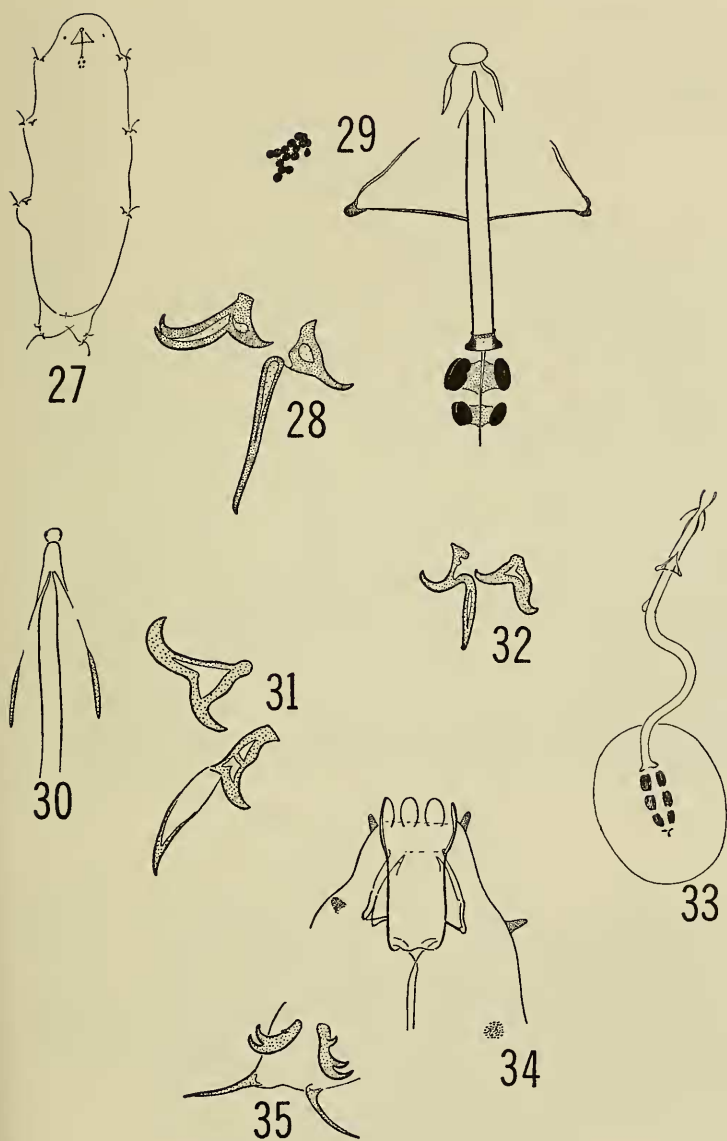
The buccal tube of this species is deflexed in lateral view (Fig. 25), and the pharynx contains the apophyses and two macroplacoids, with the first placoid incised at the middle. Eye spots are present. Each leg has a gibbosity anterolaterally; those of smaller individuals are smooth and those of larger specimens are slightly tuberculate.

The gibbose areas of the legs are not as markedly tuberculate as indicated in the literature for either European or Brazilian populations, but the difference is in degree of development and is probably not specific.

→

FIGS. 27–29. *Hypsibius convergens*. 27. Dorsal view. 28. Claws of leg IV. 29. Buccal tube, placoids, and eye spots.

FIGS. 30, 31. *Itaquascon umbellinae*. 30. Buccal tube. 31. Claws of leg III.



FIGS. 32, 33. *Hypsibius chilensis*. 32. Claws of leg IV. 33. Buccal tube and placoids.

FIGS. 34, 35. *Milnesium tardigradum*. 34. Buccal tube and eye spots. 35. Claws of leg IV.

Forty-five specimens of lengths between 170 μ and 445 μ were collected at Cuiteco, 11 September 1969. The specimens were found in 10 samples of mosses and lichens collected from a northerly exposed bank of rocks near a stream.

Hypsibius (H.) convergens (Urbanowicz, 1925)

Figures 27-29

A very thin buccal tube (2.1-2.8 μ) with the stylet supports attached near the middle, and a pharynx containing apophyses and two unequal macroplocoids (Fig. 29) are characteristic of this species. The interior surface of the first macroplocoid is weakly incised. Eye spots are present.

Single specimens were collected at Temoris, 10 September 1969, from the base of an oak stump, and at Cuiteco, 11 September 1969, from a bank of rocks near a stream. Seventeen specimens were collected at Creel, 8 September 1969, in open oak and pine forest. The shortest specimen is 185 μ long and the longest is 280 μ .

Hypsibius (Diphascion) chilensis Plate, 1888

Figures 32, 33

The buccal tube is very thin, 23 μ long and 1.7 μ diameter for a specimen 200 μ long (Fig. 33). The pharyngeal tube is the same diameter and about 30 μ long. The pharynx is oval and contains apophyses, three macroplocoids of equal length, microplocoids, and a septulum. Eye spots are absent.

Two specimens, 200 μ and 210 μ long, were collected at Cuiteco, 9 August 1969 from a sample of shelf fungus on a dead oak branch; the tree was in a small arroyo with a northerly exposure.

Itaquascon Barros, 1939

Itaquascon umbellinae Barros, 1939

Figures 30, 31

The buccal tube (Fig. 30) is very thin, approximately 2 μ in diameter, and the posterior end is not annulate.

Two specimens, 190 μ and 300 μ long, were collected at Cuiteco, 11 September 1969 from moss on a rocky bank near a stream. All of the New World collections of *Itaquascon* have been referred to *umbellinae*, mainly because the buccal tubes have a diameter of less than 2½ μ .

Milnesium Doyère, 1840

Milnesium tardigradum Doyère, 1840

Figures 34, 35

Specimens of *M. tardigradum* are recognized by the two pairs of cephalic papillae, a short, wide buccal tube, and the absence of placoids

(Fig. 34). One of each pair of double claws has only a single branch (Fig. 35).

A common and cosmopolitan species, 103 specimens of *M. tardigradum* were present in 21 separate samples from Temoris, Cuiteco, and Creel. *Milnesium* was found in a variety of habitats, which for Cuiteco included shelf fungus on dead oak; liverwort in crevices of wet bank; lichens and mosses in many situations on living and on dead trees, on rocks in spring seepage, in drier areas in filtered sun beneath oaks, and on rock cliffs.

Discussion: The 158 samples were distributed as follows: Choix 6, Temoris 85, Cuiteco 55, and Creel 12. Fifteen species of tardigrades were recovered from these samples. I expect that a few additional species would have been found if the areas around Choix and Creel had been sampled as extensively as Cuiteco and Temoris. One or two aquatic species should also occur in the streams, but the interstitial habitat was not examined.

Seven of the 15 species from the Barranca del Cobre are cosmopolitan. These species are *Macrobiotus richtersi*, *M. areolatus*, *M. hufelandii*, *M. intermedius*, *Hypsibius convergens*, *H. chilensis*, and *Milnesium tardigradum*. Five of the remaining species are widespread, occurring on two or more continents. This group includes: *Echiniscus viridus*, *Pseudochiniscus suillus facettalis*, *Macrobiotus harmsworthi coronatus*, *Hypsibius evalinae*, and *Itaquascon umbellinae*. Two of the species are unidentified, and only one, *Echiniscus tamus*, is known from only North America.

There is no indication of endemism for this assemblage of species and, because the tardigrade fauna of Central America is so poorly known, the species composition cannot be compared with that of adjacent areas.

Acknowledgments: Dr. William A. Weber, University of Colorado, and Drs. Lyman B. Smith and Amy Jean Gilmartin, National Museum of Natural History, kindly identified the plant species of *Usnea* and *Tilandsia*.

LITERATURE CITED

- RAMAZZOTTI, G. 1965. Il Phylum Tardigrada (1° Supplemento). Mem. Ist. Ital. Idrobiol. 19: 101-212.
- RIGGIN, T. G., JR. 1962. Tardigrada of southwest Virginia: with the addition of a description of a new marine species from Florida. Virginia Agr. Exp. Sta. Tech. Bull. 152: 1-145.
- SCHUSTER, R. O., AND A. A. GRIGARICK. 1966. Tardigrada from the Galapagos and Cocos Islands. Proc. Calif. Acad. Sci. 34(5): 315-328.
- . 1970. Tardigrada of Santa Cruz Island, California. Pan-Pacific Entomol. 46(3): 184-193.

